Tucannon Spring/Summer Chinook Population

The Tucannon River Spring/Summer Chinook population (Figure 1) is part of the Snake River Spring/Summer Chinook ESU which has five major population groupings (MPGs), including: Lower Snake River, Grande Ronde/Imnaha, South Fork Salmon River, Middle Fork Salmon River, and the Upper Salmon River group. The ESU contains both spring and summer run chinook. The Tucannon population is a spring/summer run, and is one of two historic populations in the Lower Snake River MPG. The other historic population in the Lower Snake MPG is Asotin Creek that was recently classified as functionally extirpated. For general descriptions of the Tucannon and Asotin subbasins see NPPC (2004) or the Snake River Salmon Recovery Plan for Southeast Washington (2005).

The ICTRT classified the Tucannon River as “Intermediate” in size based on historical habitat potential (ICTRT 2005). This classification requires a minimum abundance threshold of 750 wild spawners with sufficient productivity to exceed a 5 % extinction risk on the viability curve (at least 1.6 recruits per spawner at the minimum threshold abundance) (ICTRT 2005). Additionally, the Tucannon spring/summer Chinook population was classified as a type (A) population (based on historic intrinsic potential) because of its relatively simple and linear spatial structure (ICTRT 2005).

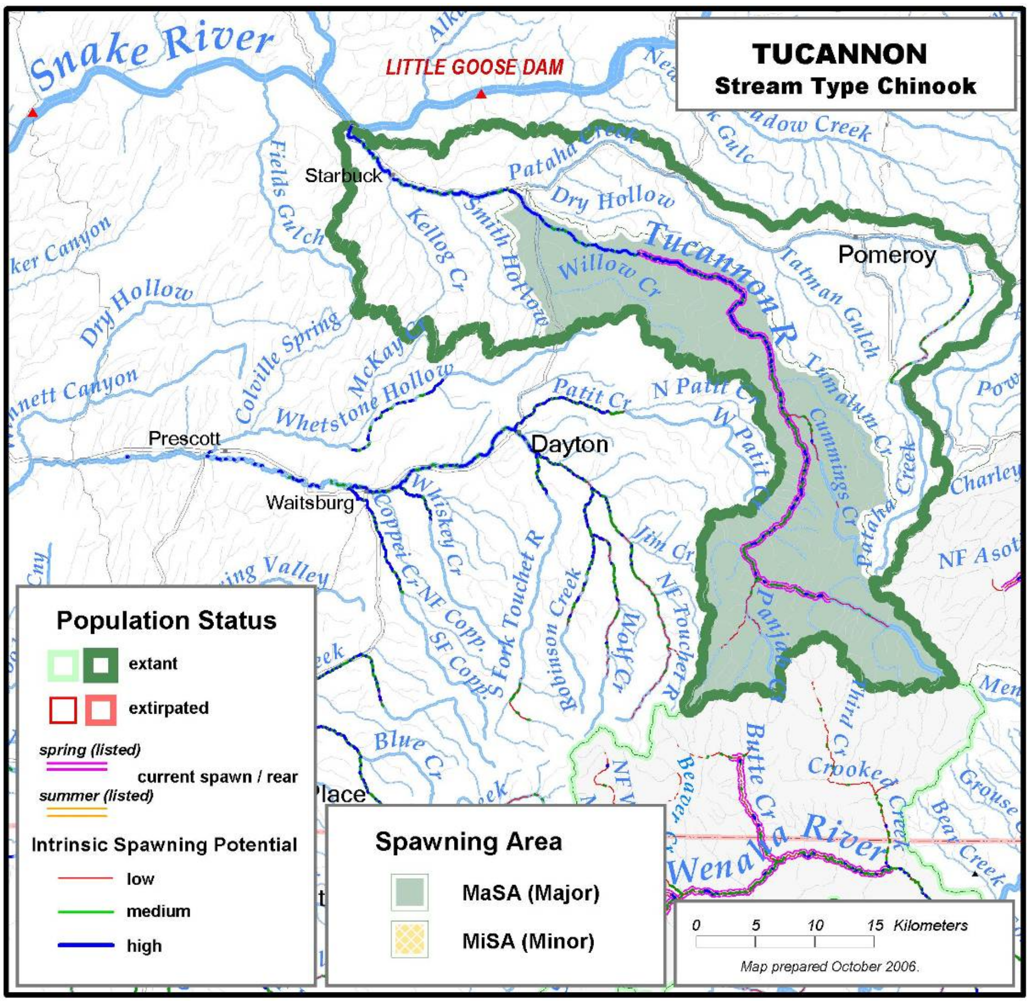

Figure 1. Tucannon River Spring Chinook population boundaries and major and minor spawning areas.

Table 1. Tucannon Spring Chinook Basin Statistics

Drainage Area (km2)	1,304
Stream lengths km* (total)	488.7
Stream lengths km* (below natural barriers)	476.1
Branched stream area weighted by intrinsic potential (km2)	0.717
Branched stream area km2 (weighted and temp. limited)	0.120
Total stream area weighted by intrinsic potential (km2)	0.808
Total stream area weighted by intrinsic potential (km2) temp limited	0.189
Size / Complexity category	Intermediate / A
Number of MaSAs	1
Number of MiSAs	0

*All stream segments greater than or equal to 3.8m bankfull width were included
**Temperature limited areas were assessed by subtracting area where the mean weekly modeled water temperature was greater than 22°C.

Current Abundance and Productivity

Recent (1979 to 2003) abundance (number of adult spawning in natural production areas) has ranged from 897 in 2002 to 11 in 1995 (Figure 2).

Abundance estimates are based on expanded redd counts. Recent year natural spawners include returns originating from naturally spawning parents, and from the Lyons Ferry Hatchery directed supplementation program (which uses natural origin and hatchery origin broodstock from the Tucannon in an approximate 1:1 ratio). Spawners originating from naturally spawning parents have comprised an average of 70% since 1979. The most recent 10-year average contribution of naturally produced returns on the spawning grounds has been 47%, ranging from 1% (in 1999, where nearly all natural spawners were removed for broodstock) to 71%.

Abundance in recent years has been widely varied; the most recent 10-year geomean number of natural spawners was 88. During the period 1979-1998, returns per spawner for spring chinook in the Tucannon population ranged from 0.11 in 1990 to 6.55 in 1998. The most recent 20-year (1987-1998) geometric mean, SAR adjusted, delimited at 75% of the threshold returns per spawner was 0.86 (Table 2).

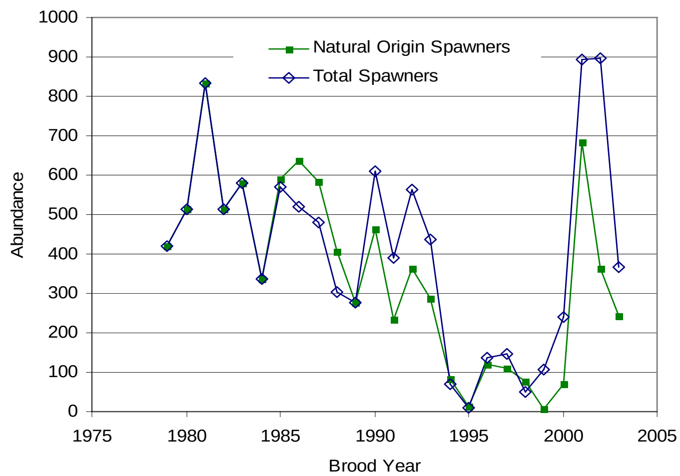

Figure 2. Tucannon River abundance trends 1979-2003. Natural origin spawners include natural spawners removed for broodstock.

Table 2. Tucannon Spring Chinook abundance and productivity measures

10-year geomean natural abundance	88
20-year return/spawner productivity	0.76
20-year return/spawner productivity, SAR adj. and delimited*	0.86
20-year Bev-Holt fit productivity, SAR adjusted	1.18
Lambda productivity estimate	1.00
Average proportion natural origin spawners (recent 10 years)	47%
Reproductive success adj. for hatchery origin spawners	No data available

*Delimited productivity excludes any spawner/return pair where the spawner number exceeds 75% of the threshold. This approach attempts to remove density dependence effects that may influence the productivity estimate.

Comparison to Viability Curve

- Abundance: 10-year geomean Natural Origin Returns
- Productivity: 20-year R/S adjusted for marine survival and delimited at 563 spawners.
- Curve: Hockey-Stick curve
- Conclusion: Tucannon Spring Chinook population is at **HIGH RISK** based on current abundance and productivity. The point estimate is below the 25% risk Curve.

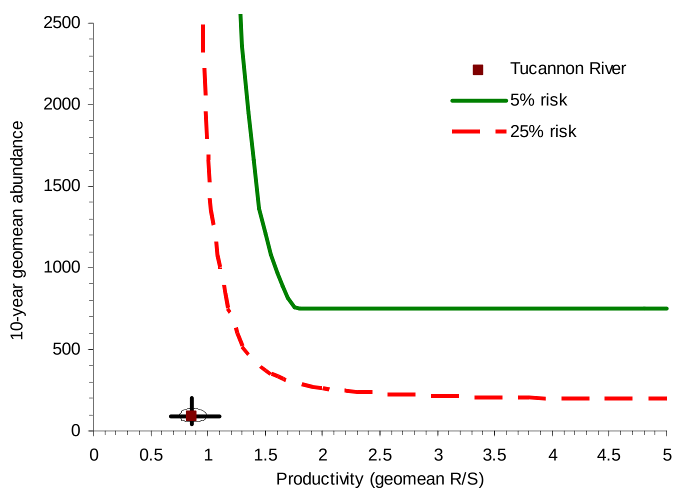

Figure 3. Tucannon River Spring Chinook abundance and productivity metrics against a Hockey-Stick viability curve for the Snake River Spring/Summer Chinook ESU. Estimate shown with a 1 SE ellipse, 1 SE X 1.75 productivity line, and 1 SE X 1.81 abundance line.

Spatial Structure and Diversity

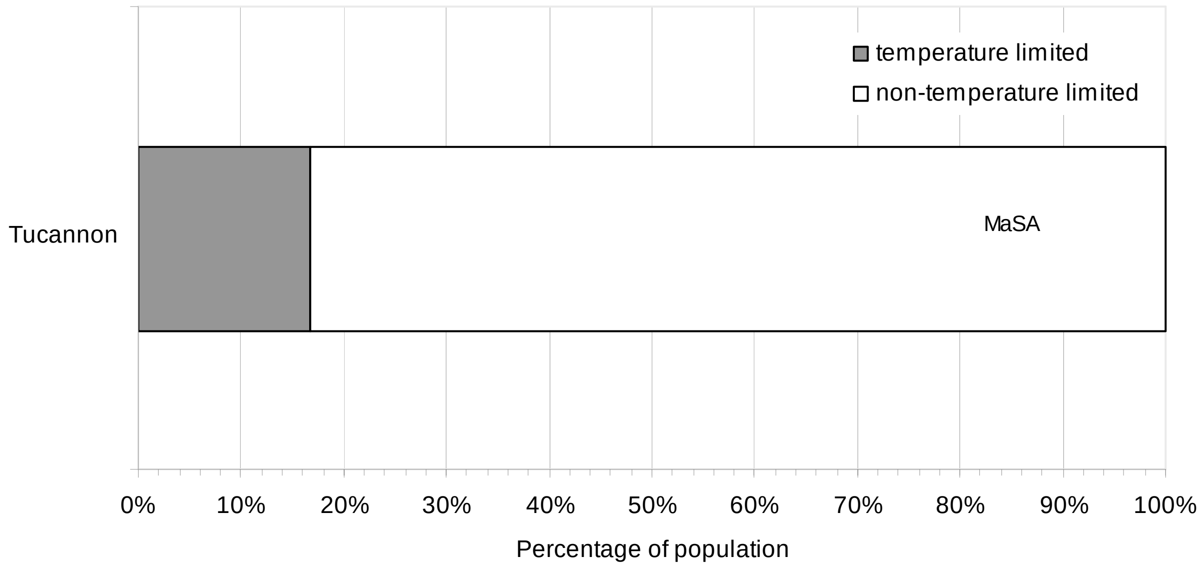

Figure 4. Percentage of historical spawning habitat by major/minor spawning area. White bars represent current temperature limited areas that could potentially have had historical temperature limitations.

Factors and Metrics

A.1.a Number and spatial arrangement of spawning areas. The Tucannon spring Chinook population has one MaSA (Tucannon mainstem). The Tucannon mainstem MaSA has been occupied in both the upper and lower halves (Salmonscape 2003;Gallinat and Ross 2005), and the branched intrinsic potential capacity of the currently occupied area is seven times greater (0.717 km^2) than the minimum capacity of an MaSA (0.1 km^2) (Table 1). Therefore, the Tucannon spring Chinook population is at *moderate risk* for this metric. The Tucannon can never achieve a less risky status for this metric, due to the single MaSA linear configuration of the population.

A.l.b. Spatial extent or range of population.

The single MaSA in the Tucannon population has had multiple redds in the upper and lower halves, and is therefore at *low risk* for this metric (Gallinat and Ross 2005).

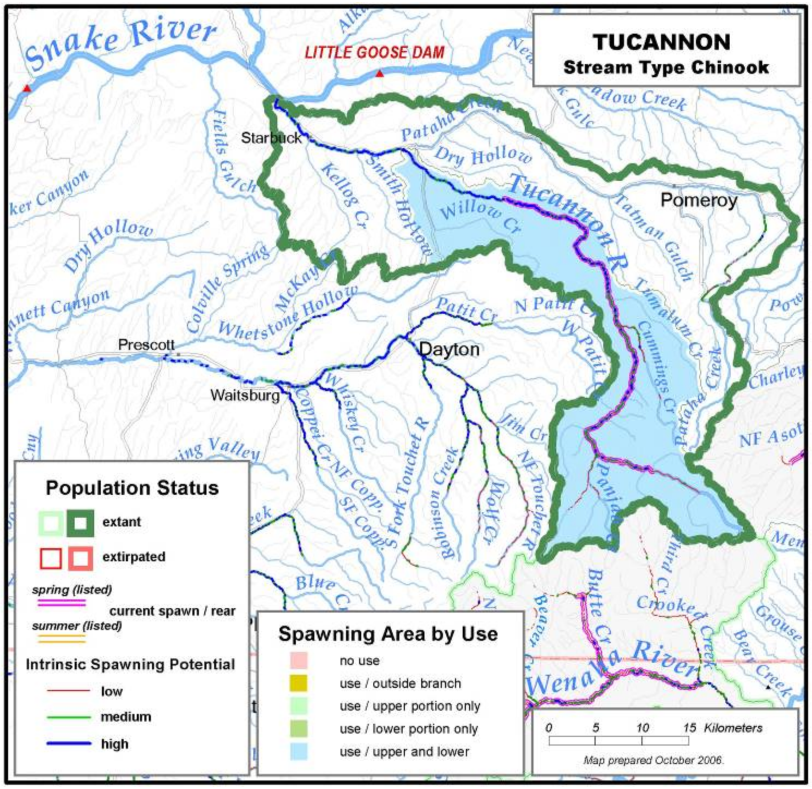

Figure 5. Tucannon River Spring Chinook current spawning distribution.

A.1.c. Increase or decrease in gaps or continuities between spawning areas. The population is at *low risk* for this metric because there is only one MaSA and it is occupied so there were not increased gaps between MaSAs.

B.1.a. Major life history strategies. The Tucannon spring Chinook population is *very low risk*, because no major life history strategies have been lost.

B.1.b. Phenotypic variation. We do not have data available for this metric. Even if we determined that there was a change to one or more traits we do not know what the exact baseline is because changes likely occurred before there was biological monitoring. Therefore, we will assume that there has been some change and increase in variance for 2 or more traits placing the population at *moderate risk*.

B.1.c. Genetic variation. Tucannon spring/summer Chinook had consistent allele frequency profiles that were distinct from all other populations/MPGs and there was minimal hatchery influence apparent in genetic signal. Therefore, the population was considered *low risk* for this metric.

B.2.a. Spawner composition.

(1) *Out-of-ESU strays*. The mean spawner composition from hatchery fish outside the ESU was 4.6% from the most recent generation (2000-2004). This places the population at *low risk* for this metric. However, the high percentage (6-12%) of Umatilla origin Chinook in some years (1999, 2000, 2002) was at a level that would put the population at moderate risk, if they occur more frequently in the future.

(2) *Out of MPG strays*. The mean percent of out-of-MPG (but within ESU) strays was 1% from 2000-2004 (Gallinat and Ross 2005), so the population was at *low risk* for this metric.

(3) *Out of population strays*. None of the strays were from other populations within the MPG (Asotin population), so the population is at *very low risk* for this metric.

(4) *Within-population strays*. The 15-year average (1990-2004) percent of the total run size was 49 % hatchery fish (Gallinat and Ross 2005). Broodstock collection at the weir would change that percentage slightly; however, most years were very close to a 1:1 ratio of hatchery and wild broodstock. Even assuming best management practices, this high proportion of hatchery fish on the spawning grounds for more than 3 generations places the population at *high risk* for this metric.

B.3.a. Distribution of population across habitat types.

The intrinsic potential distribution for Tucannon spring Chinook covered three ecoregions and, assuming no temperature limitations, there was only one significant ecoregion (Dissected Loess Uplands, 91 %)(Table 3). The reduction in distribution for this ecoregion, when compared to currently temperature-limited areas was not significant (< 67 percentage points) so the population was at low risk for this metric. Assuming the temperature limited historical distribution, two ecoregions had more than 10% of the spawning habitat (Table 3). Compared with the currently temperature limited areas the Canyons and Dissected Highlands decreased by 54 percentage points and the Dissected Loess Uplands increased by 32 percentage points. Since neither of these changes exceeded 67 percentage points and both ecoregions are still occupied the population is at *low risk* for this metric.

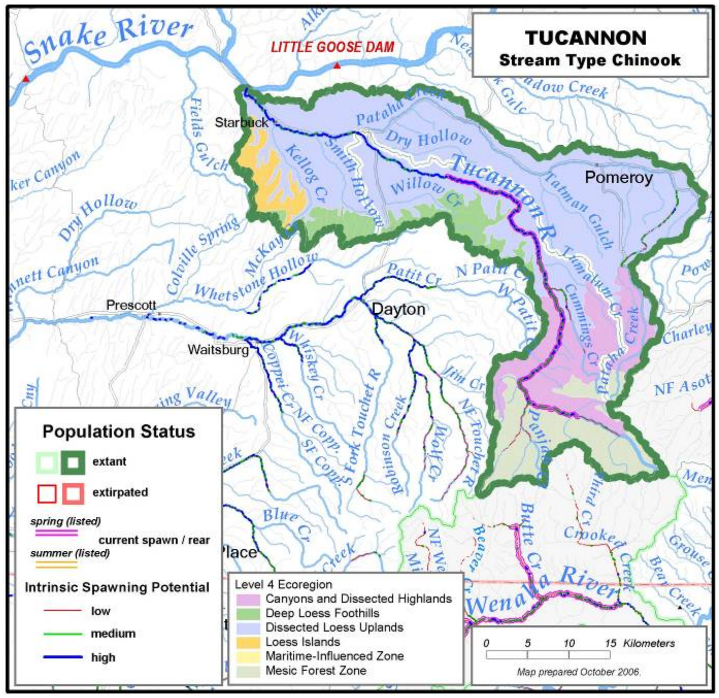

Figure 6. Tucannon River Spring Chinook population across various ecoregions.

Table 3. Tucannon Spring Chinook – proportion of spawning area across various ecoregions

Ecoregion	% of historical spawning area in this ecoregion (non-temperature limited)	% of historical spawning area in this ecoregion (temp. limited)	% of currently occupied spawning area in this ecoregion (non-temperature limited)
Canyons and Dissected Highlands	7.7	46.4	20.7
Dissected Loess Uplands	91.6	49.9	72.7
Mesic Forest Zone	0.6	3.6	6.6

*Temperature limited areas were assessed by subtracting area where the mean weekly modeled water temperature was greater than 22^{o}C.

B.4.a. Selective change in natural processes or selective impacts.

Hydropower system: The hydropower system and associated reservoirs impose some selective mortality on smolt out migrants and upstream migrating adults. The hydrosystem has slowed out migration for early and late out migrants; however, in recent years flow augmentation has reduced the impact to the middle 95% of the run. Additional selective pressures of the hydrosystem that warrant further evaluation to rate this metric include size selective predation by piscivores (Baldwin et al. 2003; Fritz and Pearsons 2006) and size-based differential passage mortality through the hydro projects. The magnitude of selective mortality and the proportion of the population that is affected are unknown. The selective mortality is not likely to remove more than 25% of the affected individuals, thus we have rated this metric as *low risk*. However, a quantitative assessment using empirical data was not conducted, so there was considerable uncertainty in the conclusion that there are not selective pressures acting on the population that warrant a higher risk rating. When additional information is available this component of selectivity should be re-evaluated.

Harvest: Low risk in recent generations. Harvest rates effect < 20% of the adults and selective gear reduces the impact of selectivity.

Hatcheries: Low risk, broodstock management of the Tucannon River supplementation program has been designed to be non-selective.

Habitat: Low risk, although low flow, high temperatures, and high sediment exist in the lower Tucannon River and Pataha Creek which could potentially effect run timing.

Based on low risk estimates across the four sectors, we conclude that the population is at *low risk* for this metric.

Spatial Structure and Diversity Summary

The Tucannon spring/summer Chinook population was rated as low risk for goal A and moderate risk for goal B, giving it an overall spatial structure and diversity rating of moderate risk. For goal B, status could be improved by addressing B.1.b (phenotypic variation) and B.2.a.4. (local origin spawner composition). For B.1.b. (phenotypic variation), an analysis needs to be conducted that shows that the phenotypic traits of the current population are consistent with the assumed historical condition or with unaltered reference populations in a similar habitat, geologic, and hydrologic setting. Based on the scoring system, this metric must be addressed in order for the status of goal B to improve to low risk. However, factor B.2.a.4. (local origin spawner composition) was at high risk and the proportion of hatchery fish on the spawning grounds would need to average less than 15% because of the long duration (3-4 generations) of the hatchery program.

Table 4. Spatial structure and diversity scoring table

Metric	Risk Assessment Scores				
	Metric	Factor	Mechanism	Goal	Population
A.1.a	L (1)	L (1)	Low Risk (Mean = 0.66)	Low Risk	**Moderate Risk**
A.1.b	L (1)	L (1)			
A.1.c	M (0)	M (0)			
B.1.a	VL (2)	VL (2)	Moderate Risk (0)	Moderate Risk	
B.1.b	M (0)	M (0)			
B.1.c	L (0)	L (0)			
B.2.a(1)	L (1)	High Risk (-1)	High Risk (-1)		
B.2.a(2)	L (1)				
B.2.a(3)	VL (2)				
B.2.a(4)	H (-1)				
B.3.a	L (1)	L (1)	L (1)		
B.4.a	L (1)	L (1)	L (1)		

Overall Risk Rating:

The Tucannon spring Chinook population is not currently viable. Of particular concern is the high risk rating with respect to abundance and productivity. The population cannot achieve any level of viability without improving its status on the viability curve for both abundance and productivity. Spatial structure and diversity is currently rated as moderate. Improvement of the spatial structure and diversity status to low risk would be required to allow the Tucannon population to achieve a "highly viable" status (in addition to the improvements needed for abundance and productivity). Based on the MPG guidelines, the Tucannon population will need to achieve a highly viable status for recovery of the MPG because the Asotin population is the only other population in the MPG and it was classified as functionally extirpated.

		Spatial Structure/Diversity Risk			
		Very Low	**Low**	**Moderate**	**High**
Abundance/ Productivity Risk	**Very Low** (<1%)	HV	HV	V	M
	Low (1-5%)	V	V	V	M
	Moderate (6 – 25%)	M	M	M	
	High (>25%)			Tucannon	

Figure 7. Viable Salmonid Population parameter risk ratings for the Tucannon River Spring Chinook salmon population. This population is not currently meeting viability criteria. *Viability Key: HV – Highly Viable; V – Viable; M – Maintained; Shaded cells-- not meeting viability criteria (darkest cells are at greatest risk)*

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Tucannon River Spring Chinook – Data Summary

Data type:	Redd count expansions (Ruzycki, ODFW)
SAR:	Averaged Williams/CSS series

Table 5. Tucannon Spring Chinook run data (used for curve fits and R/S analysis). Data used in the productivity calculation are bolded.

Brood Year	Spawners	%Wild	Natural Run	Nat. Rtns	R/S	Rel. SAR	Adj. Rtns	Adj. R/S
1979	**420**	**1.00**	**420**	**505**	**1.20**	**0.87**	**439**	**1.04**
1980	**512**	**1.00**	**512**	**418**	**0.82**	**0.58**	**244**	**0.48**
1981	835	1.00	835	599	0.72	0.63	377	0.45
1982	**512**	**1.00**	**512**	**619**	**1.21**	**0.51**	**317**	**0.62**
1983	579	1.00	579	531	0.92	0.58	306	0.53
1984	**337**	**1.00**	**337**	**372**	**1.10**	**1.65**	**615**	**1.82**
1985	569	1.00	591	335	0.59	1.57	526	0.93
1986	**520**	**1.00**	**636**	**390**	**0.75**	**1.41**	**551**	**1.06**
1987	**481**	**1.00**	**582**	**276**	**0.57**	**1.83**	**504**	**1.05**
1988	**304**	**0.96**	**408**	**337**	**1.11**	**0.75**	**252**	**0.83**
1989	**276**	**0.76**	**277**	**227**	**0.82**	**1.79**	**407**	**1.47**
1990	611	0.66	463	68	0.11	4.65	315	0.52
1991	**390**	**0.49**	**232**	**48**	**0.12**	**3.01**	**143**	**0.37**
1992	564	0.56	363	116	0.21	1.65	192	0.34
1993	**436**	**0.54**	**285**	**102**	**0.23**	**1.61**	**164**	**0.38**
1994	**70**	**0.70**	**85**	**57**	**0.81**	**1.04**	**59**	**0.85**
1995	**11**	**0.39**	**14**	**9**	**0.83**	**0.60**	**5**	**0.50**
1996	**136**	**0.63**	**121**	**259**	**1.90**	**0.54**	**141**	**1.03**
1997	**146**	**0.47**	**112**	**587**	**4.02**	**0.30**	**174**	**1.19**
1998	**51**	**0.59**	**78**	**334**	**6.55**	**0.30**	**99**	**1.95**
1999	107	0.01	5					
2000	239	0.24	69					
2001	894	0.71	685					
2002	897	0.35	364					
2003	366	0.56	243					

Table 6. Geomean productivity and abundance measures. Current productivity and abundance values are boxed.

	R/S measures				Lambda measures		Abundance
	Not adjusted		SAR adjusted		Not adjusted		Nat. origin
delimited	median	75% threshold	median	75% threshold	1987-1998	1979-1998	geomean
Point Est.	1.18	0.95	0.99	0.86	1.03	1.00	88
Std. Err.	0.34	0.25	0.17	0.14	0.50	0.26	0.46
count	10	15	10	15	12	20	10

Table 7. Poptools stock-recruitment curve fit parameter estimates. Productivity values and standard errors determined to be out of bounds are highlighted.

	Not adjusted for SAR							Adjusted for SAR						
SR Model	a	SE	b	SE	adj. var	auto	AICc	a	SE	b	SE	adj. var	auto	AICc
Rand-Walk	0.76	0.17	n/a	n/a	0.43	0.75	60.8	0.76	0.09	n/a	n/a	0.23	0.38	35.3
Const. Rec	215	51	n/a	n/a	n/a	n/a	64.1	214	50	n/a	n/a	n/a	n/a	62.8
Bev-Holt	2.48	1.37	369	125	0.29	0.76	57.0	1.18	0.29	778	345	0.18	0.44	33.8
Hock-Stk	1.84	0.33	146	0	0.22	0.81	55.4	1.03	0.17	318	66	0.16	0.44	31.5
Ricker	1.93	0.75	0.00239	0.00088	0.27	0.79	57.3	1.18	0.25	0.00114	0.00048	0.17	0.45	33.2

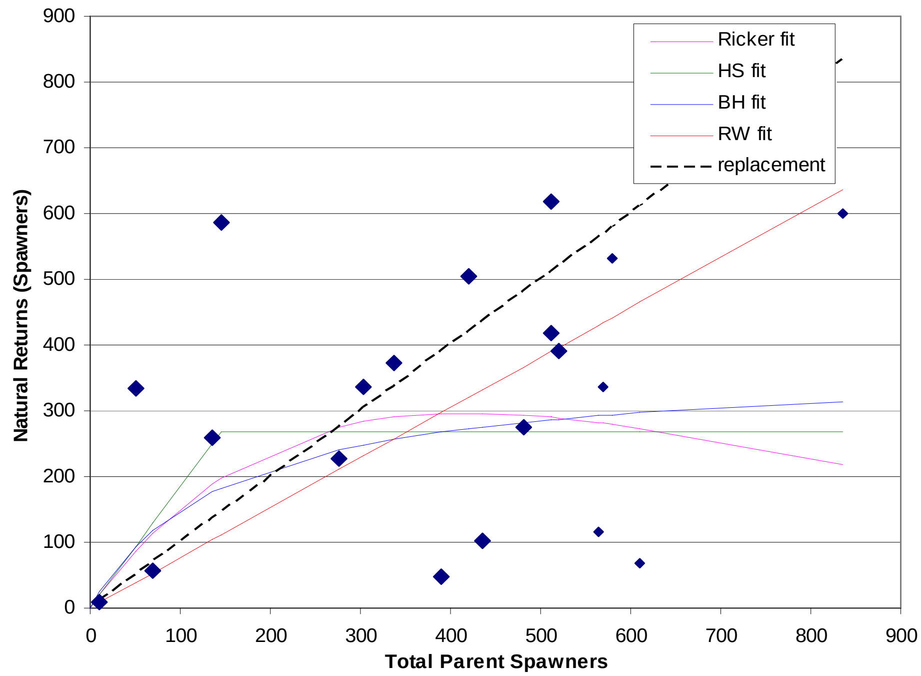

Figure 8. Stock recruitment curves for the Tucannon Spring Chinook population. Data not adjusted for marine survival. Data points used in the productivity calculation are bolded.

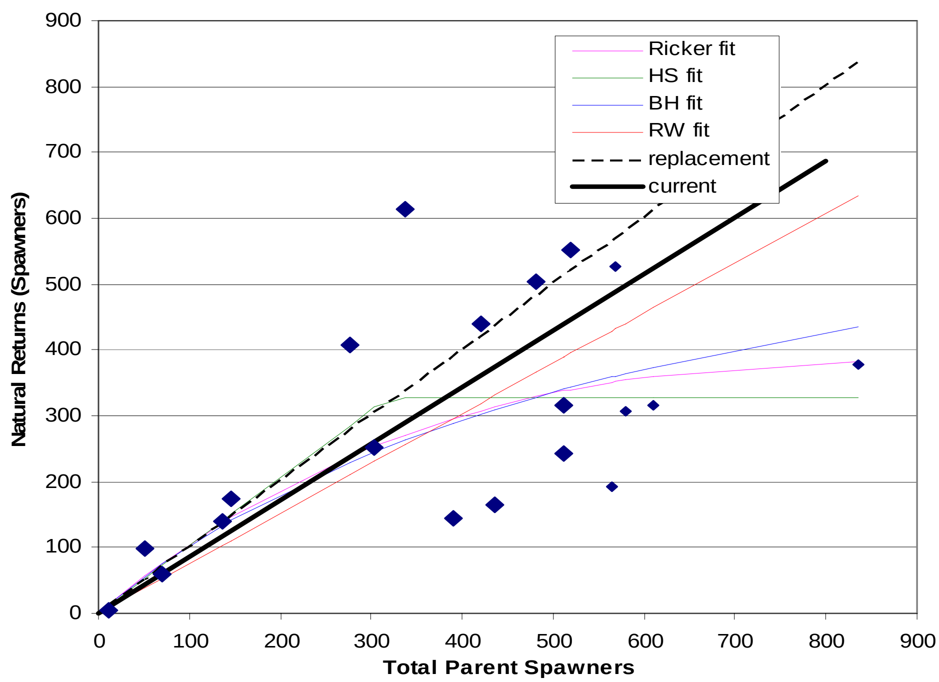

Figure 9. Stock-recruitment curves for the Tucannon Spring Chinook population. Data adjusted for marine survival. Data points used in the productivity calculation are bolded.